(12) **Patent:** (11) **CA 710230**

(54) SURFACE TINTED CONTACT LENSES

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(45) Issued on: **May 25, 1965**

(22) Filed on:

(43) Laid open on:

(52) Canadian Class (CPC): **8/3 88/39**

(51) International Class (IPC): **N/A**

Patent Cooperation Treaty (PCT): **No**

(30) Application priority data: **None**

Availability of licence: **N/A**

Language of filing: **Unknown**

SURFACE TINTED CONTACT LENSES

The present invention relates to coloring, shading or tinting of contact lenses, and more particularly relates to improvements in tinting plastic contact lenses, especially as to surface tinting of plastic contact lenses wherein the tint is non-toxic and thinly, durably and uniformly distributed only on the surface of the lens. Other aspects of the invention pertain particularly to novel techniques for reliably and selectively developing durable, uniform and homogeneous surface tinting of contact lenses, and to improved tinting compositions employed in such techniques.

Heretofore, while surface coatings or layers have been applied to optical and like lenses of the glass type, such as disclosed in German patent 816,909, such techniques have not proven practical for plastic lenses because of difficulties which arise with regard to attack of the coating solutions on the plastic lens itself, distorting the refractive properties thereof, and because of problems arising from toxicity, or lack of uniformity as to the degree of tint, or lack of durability of the coating or tint of the lens during use. One prior approach to the problem has involved use of a mineral coating such as

silica, quartz, or the deposit of metals such as platinum or gold on the surface of the contact lens, such as disclosed in U.S. patent to Gaiser 2,674,743. Another prior approach to the problem of coloring plastic contact lenses has been by incorporating coloring throughout the contact lens at the time of its manufacture, such as disclosed in U.S. patent to Moulton No. 2,241,415, a coloring substance such as a ferrous compound in finely divided form being dispersed throughout the lens material, to produce in the formed lens a desired degree of coloring.

As a result of the difficulties heretofore considered inherent in surface tinting of plastic contact lenses after manufacture thereof, it has become commercial practice to rely solely on manufacturing sources for tinted contact lenses, and to adopt coloring techniques involving dispersal of the coloring substance throughout, i.e. integrally, of the lens. Any breakage, change in prescription or desired change in degree of tint as a consequence necessitates considerable cost and delay in securing additional lenses from a lens manufacturer, often with less than fully satisfactory results in terms of the user securing a desired color or degree of tint or a substantial match of one lens to a second lens when only

one lens is ordered. Further, tinting of plastic contact lenses by an integrally dispersed coloring substance results in lack of uniformity of the tint between the two lenses when the prescription of one lens is substantially thicker than the prescription of the other lens, and the relative degree of tint as between the lenses cannot be substantially uniform except by involved trial and error at the time of manufacture of the lenses.

Independently of normal needs and uses of tinted ophthalmic lenses, it has been found to be highly desirable to temporarily provide a newly fitted contact lens user with a degree of tint or coloring in the newly fitted contact lenses, in order to cut down glare during the first week or so of adjustment or adaptation of the user to the wearing of the lenses.

Immediately after first fitting of a pair of contact lenses, a wearer tends to be somewhat photophobic or sensitive to light, often because there is an associated blepharitis or slight irritation of the eyelids. Surface tinting according to the technique here presented provides a very practical way to reduce the user's discomfort during this initial adjustment period, without getting into extensive extra cost for two pairs of lenses rather than one, and also represents a technique

whereby the extent of tinting can be periodically reduced as the user becomes accustomed to the lenses. Yet another advantage of the readily removable and readily changeable surface tinting technique for plastic lenses, as here presented, is found in certain cosmetic variations. For example, some users might prefer an iris coloring slightly darker than their natural coloring, since such tends to make the eye coloring more vivid and the eye appearance more sparkling. For instance, if one's iris coloring is pale blue, a contact lens tint slightly more blue provides more eye coloring without perceptible appearance of artificial coloring. Also, particularly with respect to female users, in a matter of simply a few minutes one can change the apparent eye coloring to match or harmonize with hair coloring or ensemble coloring, as desired. Obviously, such flexibility in use is not practical if the lenses must be returned to the manufacturer or if additional lenses must be ordered from the manufacturer in each instance where a color change is indicated.

As a result of the present difficulty in obtainment of tinted plastic contact lenses, several other advantages from slight tinting of the lenses are not realized by the large majority of users of plastic contact lenses. Some

amount of coloring has proven to materially reduce the risk of loss or breakage of lenses while such are being cleaned or handled, because a slightly colored lens can be seen much more easily than a completely clear lens, such as when the lens is in water or when dropped in bed, or on a rug or floor. Also, a slight amount of coloring enables the wearer to much more readily observe when a lens has moved off its proper position on the cornea of the eye. In addition, a slight degree of coloring, and establishing one lens just slightly darker in tint than the other, provides a simple way to distinguish the left and right lenses, which has proved to be a chronic problem to some users.

Yet another advantage of surface tinting for plastic contact lenses, is that surface tinting provides a much more practical means for restoring a tinted lens in the event a surface imperfection, such as a scratch, develops in use. According to the tinting procedure of the present invention, such surface imperfection can be removed simply by polishing in the same manner as such imperfections are removed from an untinted lens, then the tinting restored simply by retreatment of the surface tinting. In contrast, if a surface imperfection develops in a contact lens which is integrally treated, polishing is liable to produce a change in degree of tint which then cannot be restored.

Fundamental objects, features and advantages of the present invention include providing simple and reliable surface tinting techniques and tinting compositions for plastic contact lenses, which techniques are readily adaptable for practice by an optometric or like practitioner, or even a user, and which techniques obviate the necessity for having the tinting performed by the lens manufacturer. As a related feature and advantage, the tint effect and techniques of the present invention are modifiable to suit a user's personal taste, the suitability of a given degree of tint being determinable by actual trial by the user substantially immediately as the tinting operation is performed. Still further features and advantages of the present invention involve provision of surface tints for plastic contact lenses wherein the tint is evenly and durably distributed on the surface of the lenses, provides no disturbance of the prescription of the lenses, is non-toxic to the user, and is readily removable or changeable to meet the desires or needs of the user at any particular time. Yet another advantage and feature of the invention is to present a surface tinting composition and technique of use thereof which are readily adaptable to marketing and use in so-called "kit" form, with easy-to-follow directions.

The tinting technique of the present invention utilizes as a coloring composition a dye solution wherein the coloring substance itself can suitably be of a type recently developed for the dyeing of cellulose acetate or polymeric synthetic fibers, such as an azo type dye, which dye is in complete solution at normal temperature in a solvent vehicle having a selectively greater solubility for the dye substance than for the plastic of the lens. To provide certain examples of practice of the present invention, as discussed more fully hereinafter, it has been found that various azo dyes, known by the proprietary designation Cibacete dyes, when dissolved in a solvent constiting essentially of a mixture of about equal parts acetone and water, meet these requirements. Also characteristic of the present invention, the tinting technique utilizing such dye solution, involves placement of a lens for a brief time in the dye solution substantially at room temperature or slightly above, followed by removal of the lens from the dye solution and placement thereof in one or more hot water baths for one or more brief intervals, the vital purpose of such hot bath treatment being to briefly slightly soften the surface of the lens and also to facilitate the solute

character of the dye and the slight penetration thereof into the microscopic pores of the body of the plastic contact lens. Brief immersion and agitation of the lens in a hot water bath with the dye solution as an aqueous, adherent coating thereon has been discovered to be essential to the development of durable and uniform tinting of the lens, it being theorized in this respect that the adherent tinting substance microscopically spreads, intermingles and interflows with the plastic of the lens, the interflow character of the tint or stain on the lens surface being apparently promoted by the briefly encountered hotter temperature at the surface of the lens, the slight surface plasticity momentarily induced in the lens, and by the microscopic porosity of the lens. When the slight surface plasticity induced in the lens by the hot bath is stopped by removal of the lens from the hot bath, the restored complete solidification of the lens retains a substantial and relatively uniform degree of the tinting substance on all surface areas of the lens, in a manner comparable to that of a stain on a hard wood, rather than simply as a discrete layer or coating. Any excess of tinting material is then wiped off the lens and the surface tint which results has proven to be remarkably adherent and durable, as well as non-toxic to the user. Microscopic inspection of plastic contact lenses tinted according to

the present invention reveals there is no discrete layer of tint material on the surface of the lens but, rather, a slightly permeating tinting at the surface of the lens material itself. This effect, it is theorized, explains why the tint substance proves remarkably durable, adherent, and long-lasting in use.

Further, the lachrymal fluid of the eye, which has a hydrogen ion concentration very slightly on the alkaline side, does not attack the tint in any discernible degree. Yet, an important attribute and marked advantage of the tint condition characteristic of the present invention is found in the fact that such can be readily removed when desired, simply by immersion of the lens for several minutes in a solvent which is selective as to the tint substance but does not materially attack the plastic of the lens body. In practice, such a tint removing solvent can be a mixture of about equal parts of acetone and water, maintained at normal room temperature. Such removal of the tint condition simply by selective solubility demonstrates, it is further theorized, that the tint condition and relation of the tint substance to the plastic lens body is solely a physical phenomenon, not involving any chemical interaction. The pronounced selectivity of such tint removing solution at normal room temperature is

clearly demonstrated by the fact that if the temperature of such solution is raised substantially above room temperature, then attack of the lens body by the solvent also occurs. However, at normal room temperature, effective removal of the tint without disturbance of the refractive property or surface polish of the plastic lens is quite practical and readily achieved in practice.

A single hot water bath, preferably at a temperature of from about 160°F. to about 180°F., can suffice for the novel plastic lens tinting technique of the present invention, but it is better in most instances to employ two heated water baths at progressively higher temperatures. Typically and preferably the solution of the dye substance, i.e. the tint bath, is maintained at about room temperature (70°F.) and in any event less than about 130°F., the first or warm water bath is maintained at about 130°F. to about 160°F., and the second or hot water bath being maintained at about 180°F. to about 200°F. With regard to the solvent for the dye substance, and also with regard to the tint removal solvent, it has been found practical and desirable to employ as such solvent vehicle a mixture of from about 25-75% acetone and about 75-25% water, by volume.

In order to provide specific examples of practice of the present invention, attention is first directed to a suitable manner of preparing various representative tinting solutions. Several colors of dye solutions should be available, to provide a selection as to any desired color of tint, and it will be recognized that mixtures of dye solutions can also be employed. Representative dye substances for make-up into dye solutions for use in the tint bath later described are as follows:

Mfr. Name Identification	Mfg. No.	Color Index
Cibacete Red	16210	PR 234
Cibacete Violet C	16208	PR 241
Cibacete Brilliant Blue BG New	16207	PR 228
Cibacete Blue BNG	61231	PR 228
Cibacete Yellow GN	15331	PR 537
Cibacete Brown RS	61231	PR 121

As known, the Color Index identification provides an indication of the nature of the chemical structure of the various dye substances, by reference to the publication "Color Index of the British Society of Dyers and Colourists". Chemical structures of the prototype dyes indicated by the above Color Index numbers are; PR 234, a sodium salt of p-sulphobenzene-azo-resorcinol-azo-m-xylene; PR 241, a sodium salt of p-sulphobenzene-azo-4 sulpho-1-amino-8-naphthol-azo-a-napthalene; PR 228, a sodium

salt of Primuline-azo-B-naphthol-b-sulphonic acid; PR 537, a sodium salt of 6 or 7-sulpho-4-amino-a-naphthalene-azo-benzene-azo-3-sulpho-1-naphthol-6-azo-m-phenylenediamine; and PR 121, benzyl ether of p-cresol-azo-B-naphthol.

In terms of chemical classification, Cibacete Red is classifiable as a primary disazo group of the azo class, Cibacete Violet B is also classifiable as in the primary disazo group of the azo class, Cibacete Brilliant Blue BG New and Blue BNG are from the mono-azo group of the azo class, Cibacete Yellow GN is from the disazo group of the azo class, and Cibacete Brown RS is likewise from the mono-azo group of the azo class. The dye substances above designated by the proprietary term Cibacete are marketed by the Ciba Company of Fair Lawn, New Jersey.

In each instance, the various tinting solutions are prepared in the following manner. From about 6 parts to about 12 parts, and preferably about 10 parts, of the dye substance is mixed with about 200 parts of boiling water. This solution is capped and shaken well for about five minutes to dissolve in the water as much as possible of the dye crystals. The dye substance and water mix is then gradually cooled to approximately normal room temperature (70°F.), after which the dye substance is in solution and in suspension

in the water. Into this mixture is placed about 160 parts by weight of acetone (or 200 parts by volume, as compared with the water), the resulting mixture again being agitated for about five minutes. Then, to the mixture is added about 1/10 part by weight of 0.1% strength benzalkonium chloride solution, as a sterilization agent. The resulting solution is then preferably filtered through fine filter paper in order to remove any large undissolved crystals of dye substance in the ensuing tint bath, with subsequent uniformity in distribution of the dye substance over the surface of the contact lens being thus facilitated. To aid dispensing of the tinting compositions in use, it is advantageous to place the dye solution in small eye dropper bottles, such as 1/2 oz. size bottles.

A so-called "kit" can be utilized to advantage by opthalmic practitioners for performance of the tinting technique of the invention. Such a kit can contain several, usually three, such 1/2 oz. bottles of different colored tinting compositions, such as a blue, a green and a brown, such three colors being the basic colors of the human eye and being those most commonly used for opthalmic lens coloring or tinting. A fourth 1/2 oz. bottle can also be included in the kit, containing a supply of 1/10% aqueous solution of benzalkonium chloride (alkyldimethylbenzylammonium chloride in which the alkyl radicals range from C_8H_{17} to $C_{18}H_{37}$). Also in

the kit are three jars, suitably 5/16 oz. squat jars of opal colored glass. The kit also preferably includes a dipper or scoop for handling the pair of lenses together in and out of the tint bath and water baths. One excellent form of dipper for use in such a kit has been found to be one having a shallow lower tray of foraminous construction to allow ingress and egress of the bath liquid, which shallow tray is just slightly smaller in outer dimension than the inner dimension of the bath, and which has a diametrically extending, upstanding rib of a height slightly greater than the overall thickness of the contact lenses, which rib keeps the lenses separated from each other while being handled into and out of the baths. Such dipper also has an upwardly extending handle portion, emerging axially from the lower tray, with an upper tray or cover, also foraminous in construction, having a central opening fitting over the handle post, the design being such that the upper tray or cover will pass over the post and nest just inside the upper lip of the lower tray while resting on the diametric rib of the lower tray. By such arrangement, in the dipper construction, the two lower tray halves provide in combination with the rib and upper tray or cover, two isolated compartments, one for each of the pair

of contact lenses being tinted. With such a dipper, it has also been found to be an advantage to mark one side of the handle post with the letter R, for example, to designate which lower tray half is to receive the right lens.

To improve the "shelf life", another form of kit for the purpose provides the unmixed dyes in small sealed plastic containers which can be opened as necessary and mixed with the acetone-water or like solvent vehicle immediately prior to use.

As will be apparent, such "kits" are readily adaptable to use by practitioners in direct contact with users, such as opticians, optometrists and ophthalmologists, i.e. those persons involved in contact lens fitting, and also usable directly by the lens wearer under certain circumstances. Of course, the kits also include directions for use, substantially following the technique detailed below.

Typical contact lenses now in common use are of the plastic type, the chemical composition of which are essentially polymerized acrylics, such as disclosed in the aforesaid Moulton U.S. Patent No. 2,241,415 and Tuohy U.S. Patent No. 2,510,438, for example. With the desired tint color ascertained, and proceeding with the tinting of a pair of such lenses, the initial step involves first cleaning the lenses thoroughly. Usually the patient has been wearing the lenses so there is mucus, oil, dirt, etc. on the lenses and it is best to wash the lenses under running water, then take a commercial contact lens cleaner such as the proprietary hydrocarbon fluid

known as Tama, marketed by Tama, Inc. of Des Plains, Illinois. A few drops of the contact lens cleaner is placed on the lenses, which are then wiped dry, preferably with a very soft cloth such as obtainable from diaper material. The lenses are then placed in the sterilizing solution while the three bath jars are filled and suitably heated. The first jar is to contain a suitable amount of the tint bath, the second jar is to contain the warm water bath and the third jar is to contain the hot water bath.

All three jars are first preheated in hot water (at about 190°F.). Then the first jar is removed and dried and filled preferably about half full from the bottle containing the desired color of tinting solution. The slight amount of heat retained by the jar and the room temperature of the solution will result in establishment of the resulting tint bath at slightly above room temperature. Next, the second jar is removed from the preheating bath and filled with warm water to give a warm water bath in the second jar at advantageously from about 130°F. to about 160°F.. The third jar is then removed from the warm water bath and filled with water heated almost to the boiling point, the resulting temperature of the hot

water bath thus available being advantageously from about 180°F. to about 200°F., i.e. just below the water boiling point.

With the tint bath, warm water bath and hot water bath thus available, the lenses to be tinted are then placed in the holder or dipper, and completely submerged in the tint bath, the submergence being maintained with agitation for about two seconds. Then, the lenses immediately removed from the tint bath and submerged in the warm water bath, also with agitation, so that the dye solution remaining adherently on the surface of the lenses will flow freely and preclude the presence of any streaks of coloring. Agitated submergence in the warm water bath is continued for about two seconds, followed by immediate removal of the lenses and submergence thereof in the hot water bath. The hot water bath removes all of the streaks and in effect "sets" or "fixes" the dye into the surface of the lenses, the slight degree of penetration or impregnation of the dye into the plastic surfaces of the lenses imparting a permanency to the tint. After about two seconds in the hot water bath, the lenses are then removed from the bath, allowed to air cool slightly, then dried by rubbing with a soft cloth such as diaper material. If upon inspection

of the resulting tint it is determined that a darker shade is desired, then the whole process can be repeated, dipping the lenses successively first into the dye solution, then the warm water bath, then the hot water bath, as before. With a few trials, it will be observed that several possibilities are available for causing relative increase or decrease in the degree of tinting imparted to the lens. One material and readily variable factor is the time of immersion of the lenses in the tinting solution, a longer immersion resulting in a darkening of the tint. Also, another way of darkening the tint is to raise the temperature of the tint bath slightly, say to 120°F. or 130°F. Yet another way to vary the extent of coloring of the lenses is to use slightly hotter water baths, or leave the lenses immersed in the water baths slightly longer, or both. In general, however, it has been found desirable to practice the technique with comparatively lesser temperatures and comparatively shorter immersion times, favoring repetition of the tinting procedure where darker tints are desired, in order to safeguard against any possibility of either chemical attack or excessive plasticity of the lens body.

When a single hot water bath is employed in conjunction with the tint bath, a good degree of tint uniformity and durability is realized. But it has been found preferable to use two successive hot bath stages to obtain an apparent better degree of permeation of the tint on the surface of the lens body, and also to avoid any possibility of developing microscopic surface cracks in the lens as a consequence of a too abrupt temperature change. It has been found helpful on occasion to rub each lens between the fingers while holding the same under water at normal temperature, immediately after removal of the lenses from the hot water bath, to facilitate the removal of any streaking of the coloring.

With the tinted lenses removed from the hot bath, dried, and upon inspection of the degree of tint to ascertain that such has the desired shade, the lenses are then re-sterilized for a short time in the benzalkonium chloride solution, say one or two minutes, after which they are ready to again be worn. As will be evident, each sterilized lens is prepared for wearing simply by normal cleaning as by washing the lens under running water, putting a few drops of sterile wetting solution such as the commercial product for this purpose marketed by Barnes-Hind Ophthalmic Products, Inc. of Sunnyvale, California, and then placing it against the cornea of the eye.

As has been indicated, some practitioners will find it preferable to tint one lens slightly darker than the other. The difference in tint is not enough to be noticed by another person when the lenses are worn, but just enough so that if the user takes both lenses off and lays them side by side the color of one lens is a little bit lighter than the color of the other. As an easily remembered rule in this respect, it has been found helpful to the user to make the left lens slightly lighter than the right, the catch phrase in this respect being "left light". Obviously, personal variations with respect to this practice are readily available.

With regard to removal of the tint from the contact lenses, such is done advantageously by a solvent solution prepared by mixing from 25 to 75 parts water with 75 to 25 parts acetone by volume, the solvent solution being maintained at about normal room temperature or less, the lenses being left in this solvent solution until free of the tint, which will usually occur in about one or two minutes, or less, the lenses being gradually agitated in the solution if necessary. Practice of this technique has shown that the solvent solution will dissolve out the tinting material from the surface of a plastic contact lens without any effect upon the refractive nature or

surface smoothness of the lens. In practicing this tint removing technique with the indicated solution, particularly at proportionately higher concentrations of acetone in the solution, it is imperative that the temperature of the solution not exceed about 75°F., otherwise some degree of attack upon the lens body will be encountered, which is evidenced by the lens beginning to turn slightly milky in appearance. As evident, after removal of the tint from the lens, resterilization, rewashing and rewetting again places the lenses in condition for reapplication to the eyes of the user.

From the foregoing considerations with respect to various solutions and concentrations of ingredients in various tinting compositions, as well as bath temperatures employable in the tinting technique of the invention, it will be evident that the considerations involved are essentially physical rather than chemical in character. In other words, relative solubility of the tinting substance as compared with the insolubility of a given plastic lens body in the solvent employed in the tinting solution or tint removal solution determine suitability of any given tinting substance, or solvent composition, for employment in the characteristic manner of the

invention. In general, particular adaptations of the technique involve correlation of several related and variable factors, including (1) the relative insolubility of the lens body in the tint bath solution, (2) the relative solubility of the dye substance in the tint bath solution, (3) the bath temperatures employed, (4) the immersion times, and (5) the formulation of and relative solvent power of the selected dye solvent.

For purposes of practice of the invention, other suitable non-toxic dye substances capable of tinting the type of synthetic resin involved will readily occur to those skilled in the art, consistent with the indicated considerations. As will also be evident, other possibilities with respect to compositional ingredients and solvent formulations are possible, applying known solubility principles, such as inclusion of certain alcohols for all or a portion of the acetone ingredient. Likewise, other types of synthetic resin lenses can develop variations in criticality and tolerances with respect to the nature and formulation of the solvent vehicle of the tinting composition and the extent to which hot bath immersion of the tint dipped lenses are necessary, and also the particular properties of a suitable removing solvent composition, and as well as to the nature and type of dye substance employed.

From the foregoing, various further variations, modifications, adaptations and formulations characteristic of the invention will readily occur to those skilled in the art, within the scope of the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A plastic contact lens having a durable adhering, uniformly distributed, non-discrete surface tint condition imparted by a dye substance slightly impregnating the surface of said lens, said dye substance being non-toxic to humans and being substantially soluble at normal room temperature in a solvent composition consisting essentially of about 25-75% acetone and about 75-25% water, by volume.

2. A plastic contact lens of the polymerized resin type, having a uniformly distributed, non-discrete surface tint condition imparted by a dye substance of a type which is non-toxic to humans, said dye substance slightly impregnating the surface of said lens in a manner analogous to a stain.

3. A plastic contact lens according to claim 2, wherein said dye substance is an azo dye, substantially soluble at normal room temperature in a solvent composition consisting essentially of about 25-75% acetone and about 75-25% water by volume.

4. A plastic contact lens according to claim 3, wherein said dye substance is selected from the group of dyes identified by Color Index Nos. PR 121, PR 228, PR 234, PR 241, PR 537, and mixtures thereof.

5. A tinting composition for imparting a durably adhering, uniformly distributed, non-discrete surface tint condition to a plastic contact lens of the polymerized resin type, said tinting composition consisting essentially of a dye substance of a type which is non-toxic to humans, said dye substance being substantially completely dissolved in a solvent composition consisting essentially of about 25-75% acetone and about 75-25% water by volume, together with an effective amount of a sterilizing agent.

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6. A tinting composition for imparting a durably adhering, uniformly distributed, non-discrete surface tint condition to a plastic contact lens of the polymerized acrylic type, said tinting composition comprising an azo dye substance of a type which is non-toxic to humans, said dye substance being substantially completely dissolved in a solvent composition in which the lens is insoluble and non-plasticized upon brief exposure thereto at temperatures less than about 160°F.

7. A tinting composition according to claim 6, wherein said solvent composition consists essentially of about 25-75% acetone and about 75-25% water, by volume.

8. A tinting composition according to claim 7, wherein said solvent composition consists essentially of about 50% acetone and about 50% water, by volume.

9. The method of tinting a plastic contact lens of the acrylic type, comprising: dipping and agitating the lens for a few seconds in a tint bath consisting essentially of an azo type dye which is non-toxic to humans, dissolved in substantial amount in a solvent vehicle in which the lens is insoluble at normal room temperature, said tint bath being maintained at less than about 130°F.; then immersing and agitating the lens for a few seconds in a hot water bath at a temperature of about 160°F. to 180°F. to cause a slight degree of plasticity on the surface of the lens and a slight degree of permeation of the dye substance adhering to the lens onto the surface of the lens; then removing the lens from the hot water bath and substantially immediately cooling the same to about normal room temperature; and wiping the lens dry of bath water and excess dye substance to impart a durably adhering, uniformly distributed, non-discrete surface tint condition to the lens.

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10. The method of tinting a plastic contact lens according to claim 9, comprising: repeating the successive immersion of the lens in the tint bath and the hot water bath to further darken the tint of the lens until obtaining the desired shade of tint.

11. The method of tinting a plastic contact lens of the polymerized resin type, comprising: maintaining at substantially less than about 130°F. a tint bath consisting essentially of a dye of a type which is non-toxic to humans, dissolved in a solvent vehicle in which the lens is insoluble and non-plasticized upon brief exposure thereto at temperatures less than about 160°F.; briefly immersing and agitating the contact lens in the tint bath; briefly immersing and agitating the lens with an adherent tint bath coating thereon in a warm water bath; then briefly immersing and agitating the lens in a hot water bath; and then promptly cooling the lens to substantially room temperature.

12. The method of tinting a plastic contact lens according to claim 11, comprising: repeating the successive immersions of the lens in the tint bath, the warm water bath, and the hot water bath to further darken the tint of the lens until obtaining the desired shade of tint.

13. The method of tinting a plastic contact lens of the polymerized resin type, comprising: maintaining at substantially less than about 130°F. a tint bath consisting essentially of a dye of a type which is non-toxic to humans, dissolved in a solvent vehicle consisting essentially of about 25-75% acetone and about 75-25% water by volume; briefly immersing and agitating the contact lens in the tint bath; removing the lens from the tint bath; briefly immersing and agitating the lens

with an adherent tint bath coating thereon in a warm water bath maintained at from about 130°F. to about 160°F.; then briefly immersing and agitating the lens in a hot water bath maintained at from about 180°F. to about 200°F.; then removing the lens from the hot water bath; cooling the lens; wiping the lens dry; and sterilizing the lens thus tinted.

14. The method of tinting a plastic contact lens, comprising: maintaining at substantially room temperature a tint bath consisting essentially of an azo type dye substance which is non-toxic to humans, dissolved in a solvent vehicle consisting essentially of about 25-75% acetone, and about 75-25% water by volume; immersing the contact lens in the dye solution for about two seconds; removing the lens from the tint bath; immersing the lens with an adherent tint bath coating thereon in a warm water bath maintained at from about 130°F. to about 160°F.; removing the lens from the warm water bath after about two seconds immersion therein; then quickly immersing and agitating the lens in a hot water bath maintained at from about 180°F. to about 200 °F.; continuing the immersion of the lens in the hot water bath for about two seconds; then removing the lens from the hot water bath; cooling the lens; wiping the lens dry of bath water and any excess dye substance; and sterilizing the lens thus tinted.

15. The method of tinting a plastic contact lens according to claim 14, comprising: repeating the successive immersion of the lens in the tint bath, the warm water bath, and the hot water bath to further darken the tint of the lens until obtaining the desired shade of tint.

16. The method of tinting a plastic contact lens of the polymerized resin type, comprising: briefly dipping the lens in a tint bath consisting essentially of a dye of a type which is non-toxic to humans, dissolved in substantial amount

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in a solvent vehicle in which the lens is insoluble, said tint bath being maintained at less than about 130°F.; then briefly immersing the lens in a hot water bath to cause a slight degree of plasticity on the surface of the lens and a slight degree of permeation of the dye substance adhering to the lens onto the surface of the lens; then removing the lens from the hot water bath and cooling the same to about normal room temperature; and wiping the lens dry of bath water and excess dye substance to impart a durably adhering, uniformly distributed, non-discrete surface tint condition to the lens.

17. The method of tinting a plastic contact lens according to claim 16, comprising: repeating the successive immersion of the lens in the tint bath and the hot water bath to further darken the tint of the lens until obtaining the desired shade of tint.

SUBSTITUTE

REMPLACEMENT

SECTION is not Present

Cette Section est Absente